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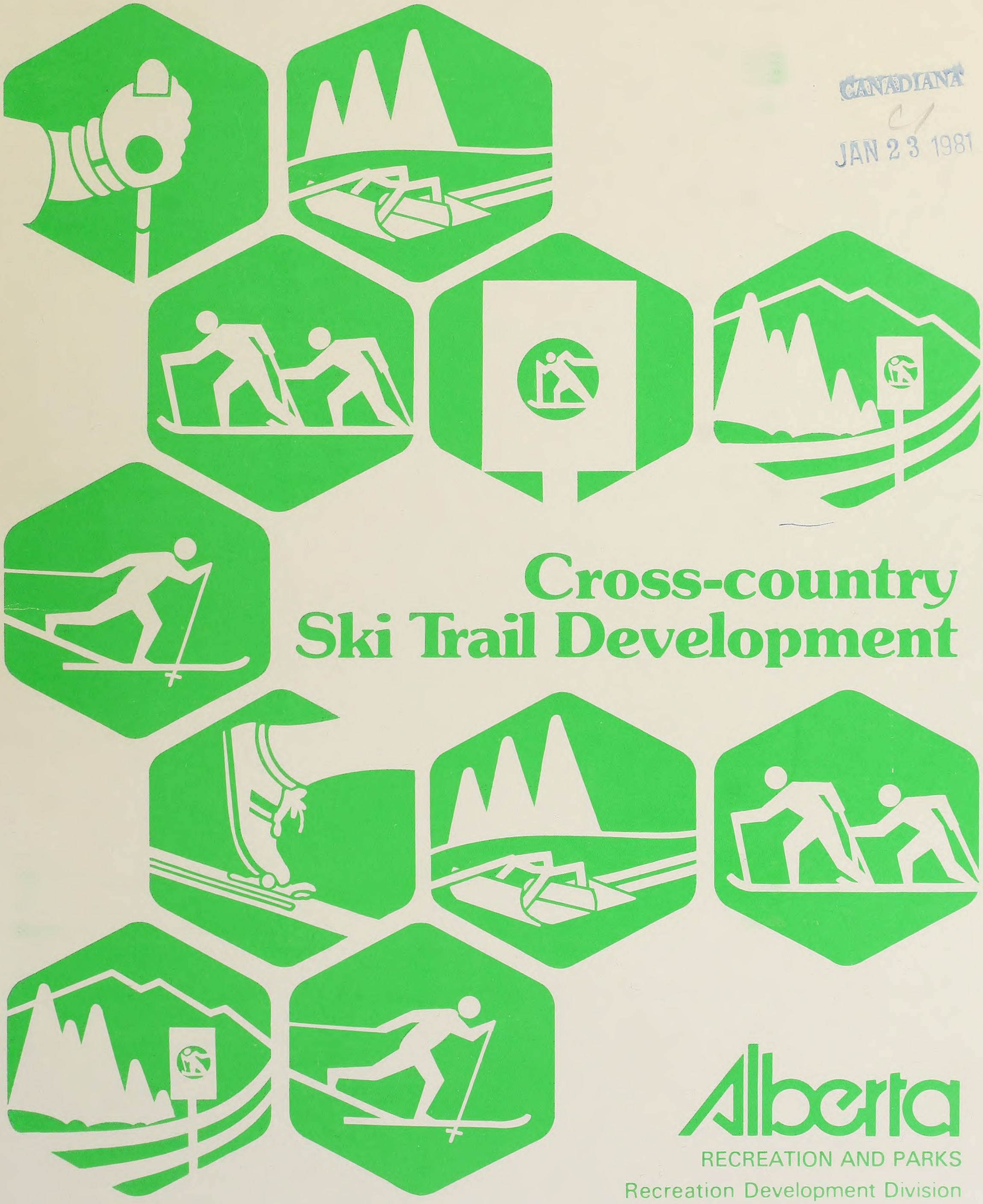

Cross-country Ski Trail Development

Alberta
RECREATION AND PARKS
Recreation Development Division

DDN 1917468

Cross-country Ski Trail Development

SEPTEMBER, 1980

Alberta
RECREATION AND PARKS
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ACKNOWLEDGEMENTS

In order to bring information together to prepare a document on developing ski trails, reference was made to several existing "ski manuals", including those by: Ben Buss, **"Edmonton Ski Trails"**; Alberta Provincial Parks, **"Cross-Country Ski Manual"** (in-house document) and others noted in the reference section of this document.

This manual was written to provide basic information, that is easy to read and easy to follow, for communities or organizations interested in establishing or up-grading their cross-country ski facilities. After reviewing numerous existing manuals on trail development, a concept was designed that was felt would best assist non-technical people in developing a high quality trail system. The format also had to be such that it would be portable for use in the outdoors and easy to follow for quick referencing.

It is hoped that this end product provides you with the information and impetus that will assist you in developing a quality cross-country ski facility to be enjoyed by all ages.

Any specific concerns regarding trail development can be directed through your regional recreation consultant or to the Recreation Planning Branch of Alberta Recreation and Parks (addresses in back). If more specific information is required as to racing standards, track setters, trail groomers, etc., that is available upon request through the Recreation Planning Centre of the Recreation Planning Branch in Edmonton.

INTRODUCTION

In recent articles in **Nordic Canada,** a magazine devoted entirely to covering cross-country skiing in Canada and abroad, full recognition of the phenomenal growth of this sport at a Canadian level is finally given. Participation rates in cross-country events, from ski-touring to racing, continue to grow from 25 to 110 percent annually in the various regions across Canada (Nordic Canada 1978).

With cross-country skiing attracting so many participants, it is essential to consider proper trail facilities to enjoy the full range of this sport.

The question arises, ''why build a cross-country ski trail system when cross-country skiers can just about go anywhere where there is adequate snow cover?'' Although ''bush-whacking'' and ''wilderness ski touring'' are important aspects of the sport, it remains that a well-designed, marked and maintained ski trail system will have the greatest appeal for all levels of cross-country skiers, especially at a community level. Furthermore, with the advent of new, improved, high performance ski products, it is found that their optimum use and best performance by the skier occurs when skiing on properly planned and designed trails that are maintained and groomed at a high level of quality.

This manual provides basic information and examples to assist in planning, developing, constructing and maintaining high quality cross-country ski trails or a ski place depending on the specific use requirements and purpose that the trail system will provide.

In some cases, the trail design and standards used may reflect multiple use activity, especially in different seasons (ie: cross-country ski trail activity in winter; hiking or equestrian use in summer).

Cross-country ski trails are relatively easy to plan and develop. Most places in Alberta have the minimum requirements necessary to establish and maintain a quality trail system.

This document is designed to give those interested in establishing a ski trail system the basic steps, procedures and considerations. It will not answer all questions but hopefully it will provide enough information so that the first steps towards developing a ski trail system can readily be undertaken.

If further information or assistance is required, your nearest Regional Recreational Consultant from Alberta Recreation and Parks should be contacted. He or she will be able to assist you or put you in contact with a Recreation Planning Consultant from Alberta Recreation and Parks.

PROGRAMMING

Before any physical planning or construction of a ski trail takes place several programming questions should already have been answered. The community or organization interested in developing a ski trail system should have identified a strong need for the facility. There should be enough indication and response from the local community to warrant the expense and time to establish a trail. Finally, a trail system is only as good as the people who use it and maintain it.

A carefully planned trail system can meet the needs of many different user groups. Whether the plan is to accommodate the local racing team or a family touring group, a good trail system is essential. As well, the community might identify when the system is to be used: during the weekday, evenings, primarily weekends, etc., to further clarify future design requirements. When working in an overall plan, year round use could also be one consideration. Identify how your trail system will relate to existing programs on the site and the types of additional programming that may be possible. Consider how the planning and development of your proposed ski trail system fits into the overall Community Recreation Master Plan, as well as into the overall existing recreation facility network that is in place and presently being utilized.

SPECIAL PROGRAMMING FEATURES

In a comprehensive ski-trail program there should be plans to accommodate different activities including instruction programs, fitness programs, racing and training programs, special user (handicapped) programs. Requirements to accommodate these programs include:

a) Flat Open Area: Most instructional programs will need a clear area, which preferably has some type of shelter from the wind. A small pond, widened stretch of river, sheltered bay or lake, open field or school playground, will all serve as ideal teaching sites.

b) Gentle Sloping Hill: A hill used for instructional purposes should have the following qualities.

   1) Long and gentle slopes steep enough to allow acceleration while traversing the slope.
   2) Long and open run-out space.
   3) Clear of any obstacles (ie: holes, trees, rocks).
   4) North facing slope — will keep snow longer.
   5) Access to bottom of hill by trail.

   The hill can be prepared by side stepping over the slope to flatten and pack all loose snow.

FITNESS PROGRAMS

Stations can be made by clearing small areas off the track to allow for exercise. A circuit training system can be set up by posting exercises at each station.

HANDICAPPED PROGRAMS

Handicapped programs can basically be carried out on the instructional areas. Further information regarding requirements to accommodate the handicapped can be obtained by contacting a consultant in the Recreation Services to Special Groups Section, Recreation Programs Branch, Recreation Development Division, Alberta Recreation and Parks.

RACING PROGRAMS

Cross-country ski races need challenging runs and distance to be able to undertake a good racing program. Further information on racing standards and programs can be obtained from the Canadian Association of Nordic Ski Instructors (CANSI) Alberta Division, or contact a consultant in the Sports and Fitness Section, Recreation Programs Branch, Recreation Development Division, Alberta Recreation and Parks.

OTHER PROGRAMS

How you layout your trail system and the variations and interest features you include in it will determine the ultimate range of program opportunities that can occur and how it can be tied into existing community programs involving a variety of other clubs, school groups or individuals. Ninety per cent in the United States are learning on packed, set trails.

SITE PLANNING

Having identified the need and a potential trail program, the next steps in trail development can be undertaken. The following basic planning steps and site considerations will assist one in identifying good trail locations, layout and standards as well as minimizing maintenance costs. Furthermore, by compiling some basic information about the trail system and preparing a few simple site maps (or plans), as suggested in these steps, it should assist one in obtaining local and government support and funding, minimize vandalism and make the trail system an overall success. A well planned trail becomes a high quality trail that is well used and requires minimal maintenance over the years.

THE PLANNING STEPS

Site Selection:

In most cases the site for developing a trail system is given. It can be some vacant land around town, a municipal park, a golf course, an environmental or forest reserve, a farm, crown land, or other suitable open space. The key factors to consider in selecting a suitable site include:

a) adequate snow cover (7-10 cm)
b) rolling topography
c) interesting landscape with views and vistas
d) good access
e) exposure to sun and weather conditions

Trail Route Selection:

Using existing topographical maps (1:15,000 minimum, if available) and aerial photographs (1:50,000 minimum scale) plot out a rough trail plan based on general knowledge of the area. Include not only the trails but probable places for parking, rest shelters and sanitation facilities (doing some pre-planning on maps/air photos can save time for future site inspections and can better prepare one for what to expect at that site).

Site Inspection:

When a route has been plotted on a map, go to the site and **walk it** for a more detailed analysis of trail location. At this stage, mark the trail using coloured surveyor's tape tied to trees, shrubs or stakes. (Note: if maps/photos are not available, the above step can be omitted and site inspection can take place immediately.)

When marking the trail on-site, keep in mind the following points to ensure good layout:

a) Try to have the trail route in a ratio of 1/3 over flat ground, 1/3 downhill and 1/3 uphill.
b) Avoid **steep slopes,** especially on down runs, unless there is sufficient run-out space provided at the bottom (3-5 times longer than height of hill) or it is in an advanced trail and clearly marked as such.

c) Remember **north** slopes retain snow longer, **south** slopes lose snow faster (however, south slopes are generally more pleasant and provide better exposure for skiing) — **south** slopes through trees using **well packed** trails provide a good compromise. (Refer to Trail Maintenance Section).

d) Sharp **dips and turns** in the trail should be avoided as they can be hazardous to the skier and pose problems during trail construction and maintenance.

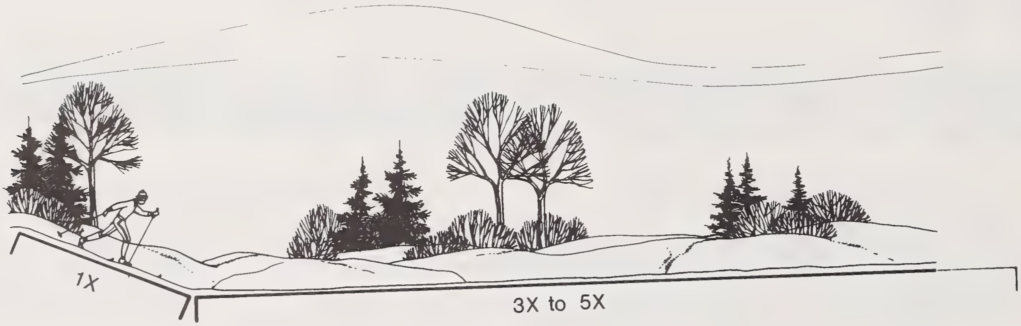
e) **Stream crossings** should be bridged, especially if water still flows in the winter.

f) When the trail **traverses** a hill, avoid **steep angles on cross slopes** so that skis don't slip out of track when crossing.

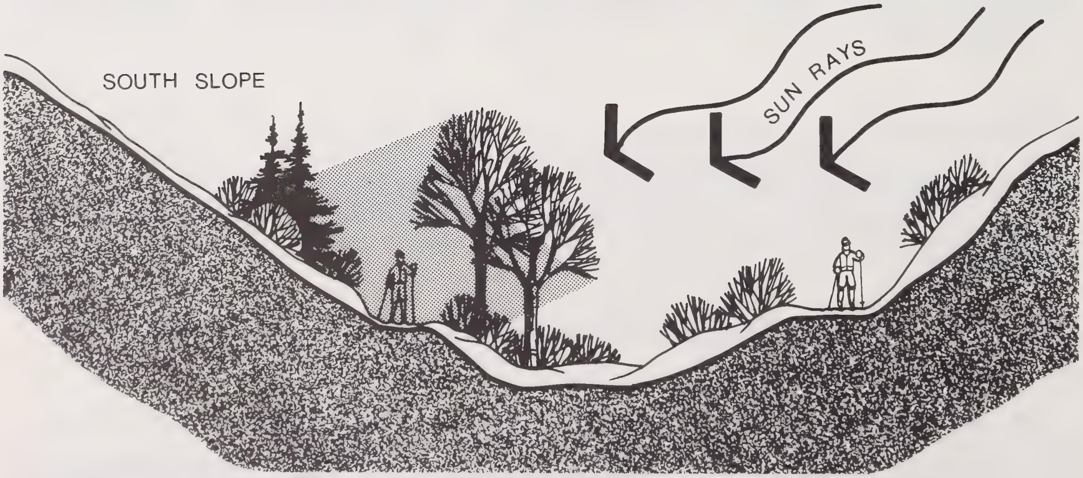
g) Trails should be located away from **prevailing winds** for the comfort of the skiers and to reduce drifting and wind packing of snow.

h) Try to include lots of **views and vistas** of the surrounding landscape by bringing the trail from low enclosed areas to high open look-outs. This provides variety and adds to the overall "trail experience" that the skier is looking for.

i) Avoid dense coniferous stands, as snow conditions underneath may not be sufficient for proper trail use.



B. — AVOID STEEP SLOPES

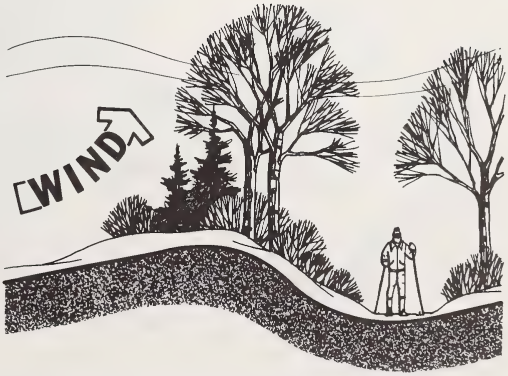


C. — NORTH SLOPES RETAIN SNOW LONGER

D. — AVOID SHARP DIPS AND TURNS

E. — BRIDGE STREAM CROSSINGS

F. — AVOID STEEP ANGLES ON CROSS SLOPES



G. —LOCATE TRAILS AWAY FROM WINDS

H. — PROVIDE VIEWS AND VISTAS

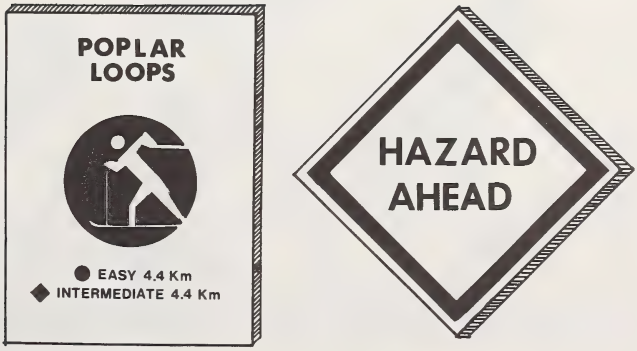
I. — AVOID DENSE CONIFEROUS STANDS

TRAIL LAYOUT:

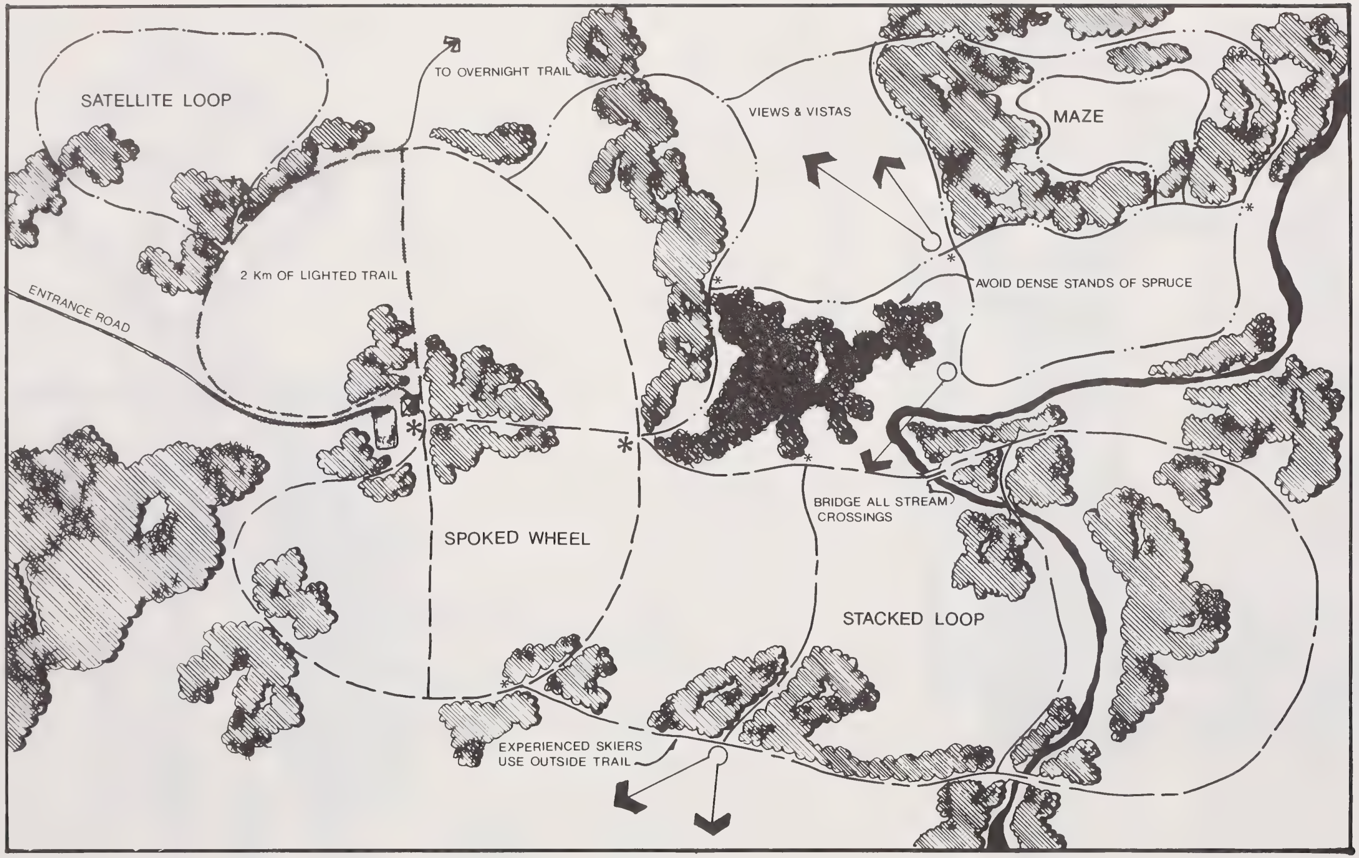
Basically, trail layout is the practical application of those site factors mentioned previously, keeping in mind the ultimate recreational use of the trail and the environmental stability of the site. On laying out a trail system, the following simple design patterns should be considered reflecting such factors as the type of users expected on the system as well as terrain limitations. Generally the best forms of layout for day-use ski trails are the stacked loop, the satellite loop, the spoked wheel and the maze forms. These can provide a variety of routes with different degrees of difficulty and distances and accommodate a wide range of skiers. The layout should be arranged such that trails can be used for partial day-use, full day-use and for return visits to a central staging area. (ie: opportunities for different routes on subsequent visits.)

Overnight ski trails of linear or loop design can also be developed.

To obtain the most distance for your trails in a small area, loops going out and coming back to a central point are the best type to lay out. Large areas do not have to consider this. Within the overall trail layout one should also include a wide, flat, open area, perhaps partially sheltered by trees, where beginners can learn the basics of cross country skiiing.



SIGN EXAMPLES



TRAIL LAYOUT

LEGEND:

- SPOKED WHEEL
- STACKED LOOP
- SATELLITE LOOP
- MAZE
- LIGHTED TRAIL

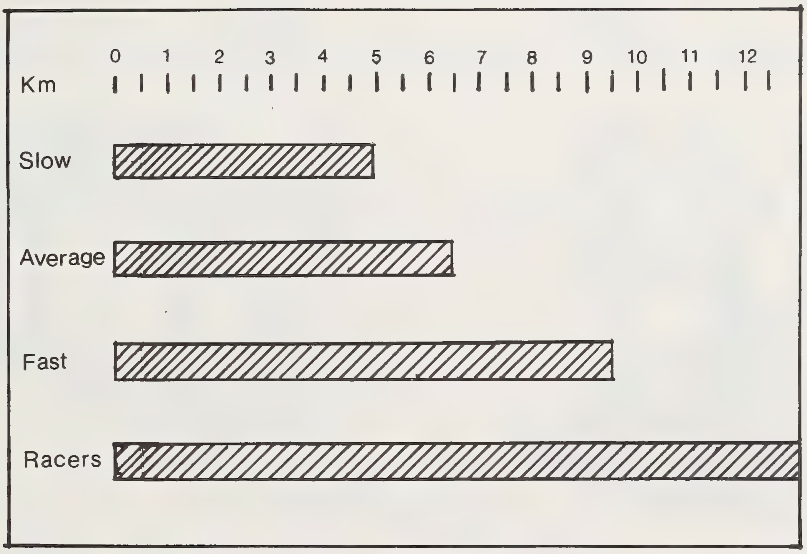
- * SIGNAGE AT TRAIL JUNCTIONS
- SKI CENTRE
- VIEWS & VISTAS

BASIC TRAIL STANDARDS

TRAIL LENGTH

Listed below are recorded average distances covered in an hour by various categories of skiers. These distances can be used as a basis for calculating trail length. (Canadian Ski Marathon, Quebec, 1972.)

CATEGORIES OF SKIERS/AVERAGE DISTANCE COVERED



Slow tourers	2-4 km/h
Average tourers	5-5.6 km/h
Fast tourers	8-9.5 km/h
Racers	9.5-13 km/h

Short loops around a central staging area (ie: lodge) should be provided for partial day-use and for use by slow and novice skiers. Working from the above figures, and assuming that some novices will be slower than slow tourers, base loops should be between 3-5 km.

For full day-use, a minimum distance of 15 to 20 km is recommended. The maximum distance depends upon the class of skier. For average tourers 22 km will probably be adequate (four hours skiing at 5.5 km/h); for fast tourers 36 km, (four hours skiing at 9.0 km/h).

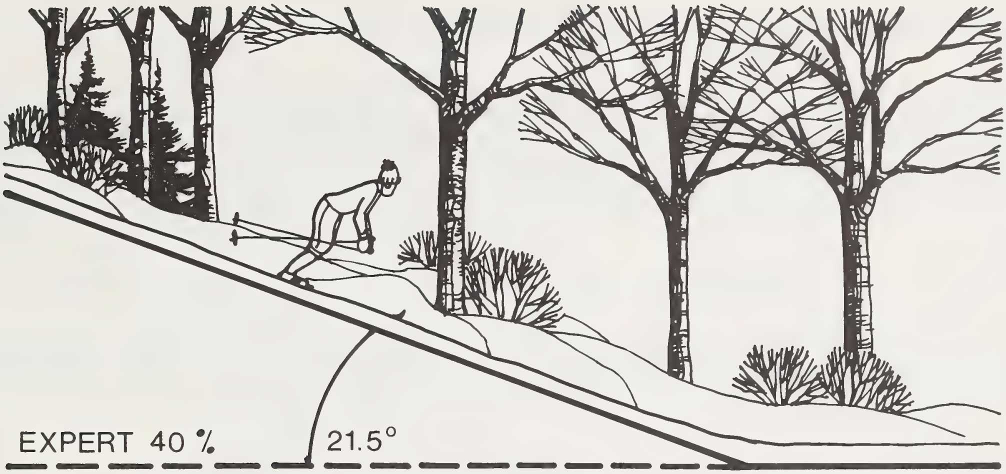
Total length for a trail system will depend on how many alternative loops can be provided on the land that is available and the type of terrain that is to be crossed.

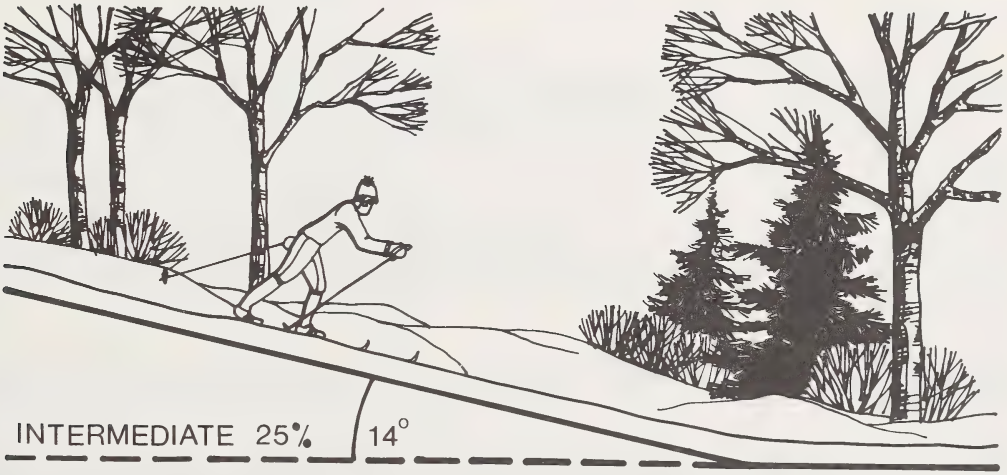
TRAIL GRADES

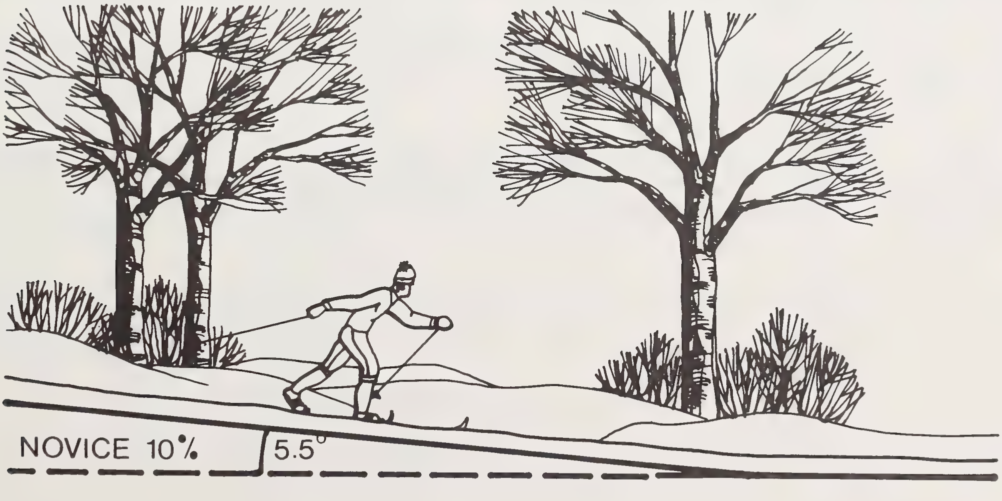
A 40% grade should be considered the maximum, even for expert skiers. On general use trails a 10-12% slope should be the maximum except for very short drops, where there is no chance of skiers losing control. On slopes greater than 8%, the trail should be wide enough to let skiers do a snowplow or herringbone.

Steep runs should be relatively short so that speeds do not become too great. Adequate runout space should be provided at the base of slopes to allow skiers to slow down before curves. Intersections with other trails or roads should be relatively smooth and curves should be gentle.

Where curves occur on long slopes the sections preceding the curves should be levelled out or run slightly uphill to assist skiers in reducing speed. Sharp curves should be banked to the inside.


EXPERT 40 %
21.5°


INTERMEDIATE 25%
14°


NOVICE 10%
5.5°

RATING TRAILS FOR DEGREES OF DIFFICULTY

To ensure the safety of skiers, trails should be marked to indicate the degree of expertise required. The base loop of a trail system should be suitable for novices, while secondary loops can be used to provide conditions suitable for more experienced skiers. The following identifies more specifically the types of conditions required by different types of skiers.

Novice:

Downhill runs should have a maximum grade of 10 percent. Trails crossing slopes diagonally should be wide and gentle. Several short slopes are preferable to long slopes. With short slopes, speeds do not become too great and climbing is not tiresome. Descents with steep side slopes are difficult for inexperienced skiers and should be avoided.

Remember to include flat, open areas where beginners can practice techniques.

Intermediate:

Maximum grade for downhill slopes should be 25 percent. Curves may be sharp, but ample room should be left for ''over-shooting''. Up to one third of the trail may be uphill with some steep, but short, climbs.

Expert:

Maximum grade for downhill slopes should be 40 percent. Gentler grades should be used on long runs where the trail surface is rough or where there are sharp curves. Adequate 'runout' distance should be provided at the bottom of steep or long slopes. Up to one half of the trail may be uphill.

Note

Trails should be rated based on the most difficult point along a certain route. An expert trail may be skiable by a beginner especially over flat terrain; but if there is even one steep slope on the route it should be designated as an **expert** or **advanced** run at the trailhead, so that beginners do not end up getting stranded far down the trail.

Racing Trail:

As stated in the program section, racers require certain standards. If you are interested in setting up a race course and holding ''official races'' get in touch with the Canadian Ski Association, Nordic Division, to obtain exact requirements and direction. (Refer to section ''Additional Sources'').

TRAIL CONSTRUCTION

If you have preplanned your trail and have walked the site carefully flagging and marking the exact route you wish to follow, the construction aspects of trail development should be made easier. What exactly is required for proper trail construction and how can this be accomplished effectively and inexpensively? To begin with, having the proper tools and knowing how to use them can greatly assist initial trail construction and future maintenance programs.

The following is a list of basic tools one might consider for ski-trail construction:

Hand Tools	— Chainsaw — Gas-powered brush cutter — Brush hooks or saws (with extensions) — Single blade axe — Polaski — Pruning shears (long handled) — Fire rake
Mechanized Equipment	— Small garden tractor — Bobcat (less than — Morrison trail blazer 1.5m blades) — Hydro-axe/Gravely (wood chipper)
Heavy Duty Equipment	— Backhoe digger — Caterpillar D-4 (2.7m blade) — John Deere 450 (2.1 m blade)

Note

Extreme care should be taken if heavy duty equipment is being used, because the surrounding environment can be easily damaged through carelessness and the end trail product will not be as enjoyable to ski.

The key to minimizing trail construction costs and future maintenance problems lies with making sure the final trail route avoids any major physical problems that can cause trail erosion, or other trail use problems (ie: trail located in severe exposure or in dense coniferous forests, etc.)

Furthermore, as cutting and clearing the trial gets underway, should unforeseen problems arise, there should be a certain amount of flexibility to re-route the trail to avoid the problems or be prepared to put more effort into overcoming the problem.

TRAIL CREWS

To help speed the cutting process a well-organized trail crew using 3 - 5 people is advantageous, especially if these crews can be organized **before** reaching the site, making sure everyone understands their particular function.

A simple trail crew can be made up of the following people:

First person	Chain saw cutter goes through cutting out major fallen logs and trees that have previously been marked for felling.

Second person	Using brush hooks and axes, this person cuts down all smaller shrubs and roots.
Third person	Using a fire-rake or similar clearing device, this person clears away all fallen debris and makes the trail surface clear of any major branches and obstacles.

These numbers can be easily doubled if more volunteers are available.

Construction using a trail crew should take place on a section to section basis. If the trail route has been plotted on a map or air photo it will simplify matters in designating different sections along the trail.

Of course, if you have the equipment and want a lot of trail cut quickly, heavy equipment can be used, but it will still require a trail crew to follow behind for clearing debris and levelling the trail surface.

TRAIL CLEARING TECHNIQUE

TRAIL CLEARING TECHNIQUE

1. Mark all trees that are to be cut beforehand so the cutter doesn't cut unnecessary trees. Be conservative in the number of trees that should be felled.

   Note: Depending on trail location and other site factors some trees may be felled to fall across the trail, to discourage use by motorbikes or snowmobiles, especially at the trailhead.

2. Using a fire rake, polaski or similar tool, brush should be cut out by the roots to prevent further growth. As it is cut it should be cleared to the downhill side of the trail and packed to provide a more even surface especially if on a slope. Dirt thrown on top from uphill, will root grass and stabilize any erosion. A slight cross-slope of 5 or 10 degress can make it difficult to use snowmobiles for tracksetting since they slip laterally. Try to ensure that the trail surface is fairly level, even if you are traversing a hill.

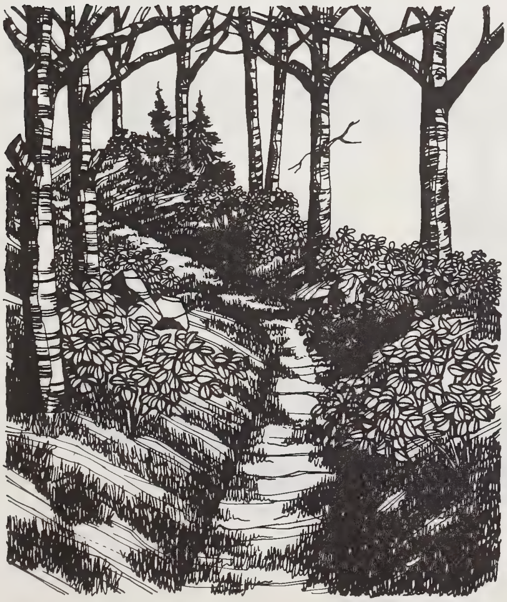
3. As you go along, ensure that all sharp projections to the side of the trail are cut off so a falling skier will not impale himself on cut branches or catch his ski in tree roots.

4. Sharp depressions should be filled or cut back to provide even contours. If there are channels for water run-off, try and find old culverts which can be placed in them before filling. This will prevent a washout each year.

5. Turns should be widened and slightly banked to assist the skier in turning, especially if going downhill.

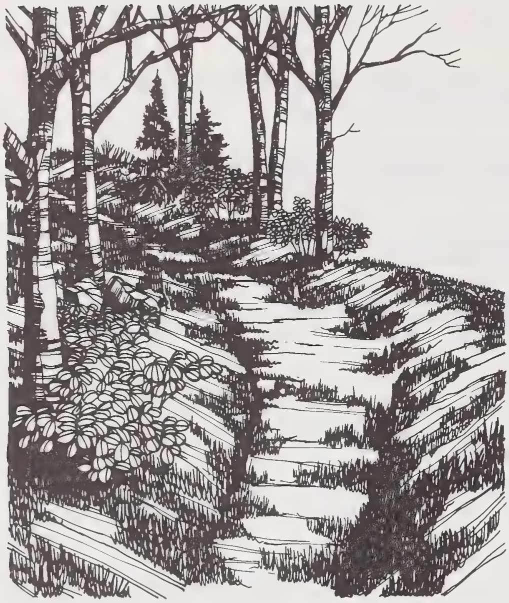
6. If cutting the trail and the growing season has not finished, plant fescue or clover in the earth cut track sections to prevent erosion and to make it pleasant to hike and train on.

7. Try not to locate the trail under a thick cover of conifer trees as snow depth underneath may not be sufficient to pack a proper trail. If the trail must go through a conifer thicket trim some of the overhanging branches so that more snow will fall on the trail.



INCORRECT TRAIL CLEARING

- Narrow Trail
- No Banking on Curve
- Plant Material not Cleared
- Sharp Angles on Banks



CORRECT TRAIL CLEARING

- — Widened Trail on Curve
- — Well Banked
- — Curve Cleared of Plant Material

CLEARING HEIGHT

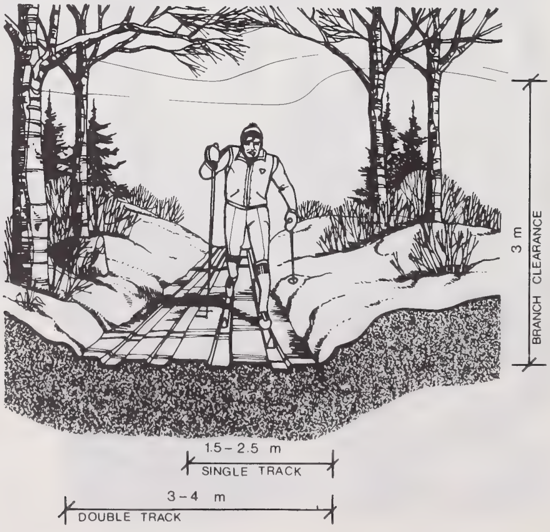
Brush and trees should be cut to a height of about 3 m keeping in mind average winter snow depth for the area through which the trail is being planned.

RIGHT-OF-WAY CLEARING

For single track trails, widths of 1.5 to 2.5 m are recommended. The narrowest width should only be used for minor trails.

For main trails, where intensive use is expected, there should be enough room for two or three sets of tracks. The maximum width for two tracks is 3 m and three tracks is 4 m.

CLEARANCE DISTANCES



If major events are being planned or a lot of use is anticipated, the first ¼ km of the trail system may be cleared to an even wider width to accommodate 5 - 10 skiers (at least 8 - 10 m wide).

Where grooming equipment is to be used, a minimum width of 2.5 m is required. This allows enough space for efficient operation and safeguards trees from being scraped by machinery.

On slopes, sufficient clearance should be allowed for the safety of falling skiers and to allow skiers room to 'herringbone' or side-step up. This will also provide space for ascending skiers to step out of the way of downhill skiers. On slopes exceeding 10 percent, curves should be banked and left clear of trees in order to allow skiers to stop safely.

On long runs widened sections should be provided at intervals to allow skiers to control their speed by stopping or running off the trail.

OPERATIONS AND MAINTENANCE

Once a trail has been built what should be done before the first snow falls?

The key to the success of your trail system comes with a clear understanding and practice of maintenance and operation techniques. Someone from the community, ski-club or other organization that is developing the trails should appoint or designate a certain individual or individuals to be responsible for trail maintenance. Whether one person does it or a rotating group of people undertake it, it is imperative that pre-seasonal checks be made.

FALL MAINTENANCE

During the fall the trail should be walked in order to clear any deadfall or trees that may obstruct the trail during the ski season. As well, the trail should be checked out for water erosion and corrected by filling the problem areas with dirt or deadfall. Make sure the staging/parking area is ready for use. Make sure your sanitary facilities (whether it is a pit privy or a chemical self-contained unit) is ready for use.

Make sure all signs are in place.

SIGNING

Trail signs are essential to safety on the trail system and also help make it more interesting and more convenient. All public trails should be signposted with trail signs and markers that are officially approved for use in the area. The most important of these recommended signs are trail identification markers, trail blazer reassurance markers, and directional signs (Bombardier Ltd. 1972).

Remember, a well constructed and maintained trail is its own best marker. Over-marking of the trail constitutes a form of visual pollution, detracts from the trail setting, and is unnecessary. (Alberta Forest Service 1977).

Signs should be placed within the eye level zone, between 140 cm and 170 cm. On winter use trails, signs should be placed 140 cm to 170 cm above the average snow level. Signs should be placed on the edge of the trail clearing so they are readily noticeable. Signs could be placed on removable wooden stakes so as not to damage any trees.

Necessary signing information and locations should include:

a) Trail heads:

    1) Trail Type (ie: single access, linear or single loop trail) — trail name, length (total distance), degree of difficulty (elevation change, and maximum grade — optional).

    2) Multi-access, or multi-looped trails — require a map sign showing the layout of the trail, trail name or segment names, stream locations, lakes, high point, locations of facilities, and length of the various segments of trails. In addition elevation change, maximum grade, and rules and regulations should be posted.

b) Junctions — names of different trails joining as well as distances and signs identifying points of interest off the trail with distances to them.

c) Direction of trail in areas where the user may get lost (particularly where fresh snow may obliterate the trail).

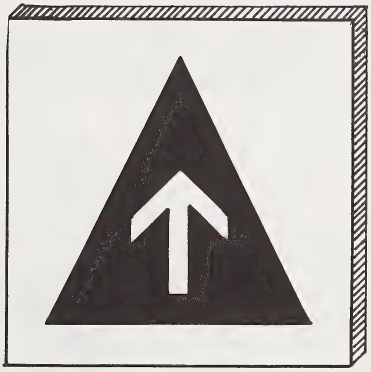
d) Warning of special hazards.

e) Location of water sources if scarce.

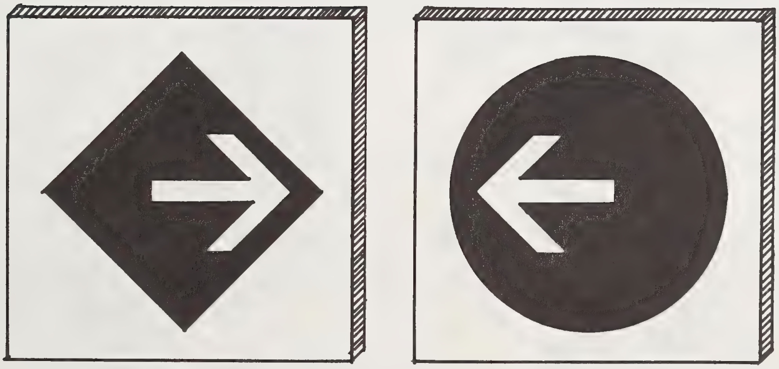
Note:

At the trail head be sure to have a sign that states your trail is a cross-country trail. Place some rules and regulations pertaining to ski-use of that trail. Try to avoid putting up NO SNOWMOBILES as psychologically this will only encourage certain snowmobilers to run over your track. Perhaps a separate snowmobile trail with separate signing for that activity is possible in conjunction with the cross-country trail. (Refer to section on Additional Factors for information on controlling snowmobile use).

Signs can be made locally using simple designs as illustrated here, or they can be obtained from certain distributors or agencies. Sometimes the breweries distribute small styrofoam directional signs as part of their winter promotion program. Getting in touch with the Provincial or National Ski Association may also identify sources for signs.



ADVANCED
RED



INTERMEDIATE
BLUE

EASY
GREEN

SIGNAGE

WINTER TRACK SETTING

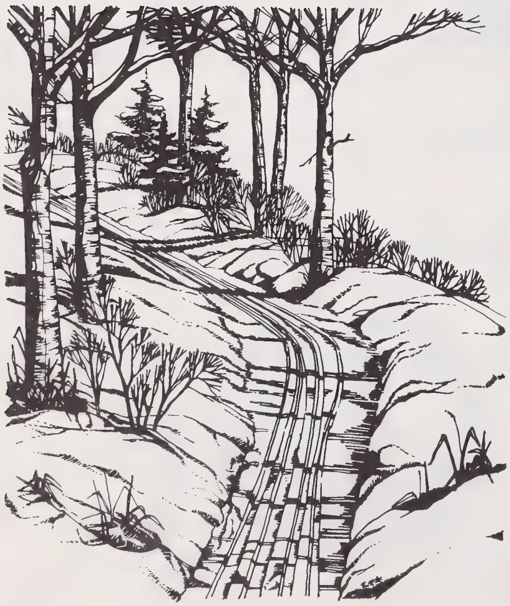
For good skiing, whether touring or racing, a set of ski tracks increase the pleasure to be had through this sport. The following points should be considered before setting a ski track:

1) At first snowfall begin by running over the trail route with a packing machine to pack down the snow. This may take 2 or 3 runs to pack the snow sufficiently for track-setting.

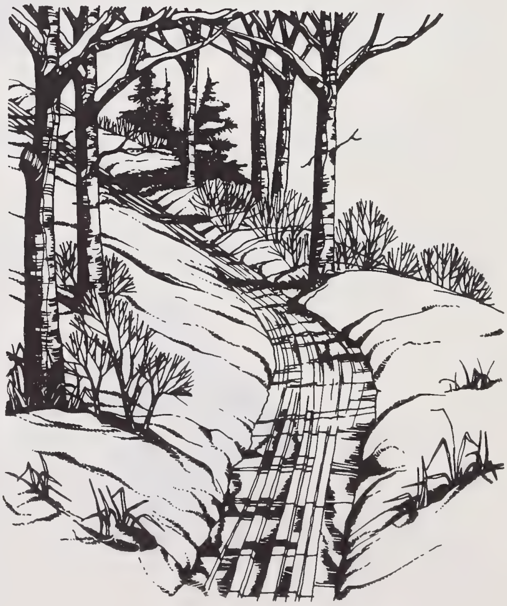
2) Once the snow is packed go over the route again using a track-setter. Depending on snow conditions this might also have to be repeated 2 or 3 times in order to get a firm track established.

3) Snow has the peculiarity of, when being disturbed, combining together and forming a more solid mass after a period of 24 hours. This fact is utilized by setting tracks at least a day ahead of when they are to be used so the skis can run in firm tracks and the poles do not sink into the snow. (Buss 1972).

4) Where possible on a trail, a pair of tracks should be set. This allows for the slower skier to step aside into the second set which gives him good directional skiing while the faster skier travels on without a break in stride. However, on hill corners skiers will invariably take the flattest turn. The tracks should be set so they come into the corner high on the outside and cut low to the inside. On slow, less tight turns parallel sets of tracks can still be used. On sharp steep corners **no** tracks should be set.



ALLOW TRACKS ON MODERATE SLOPES TO COME HIGH ON THE OUTSIDE AND CUT LOW TO THE INSIDE.



DO NOT SET TRACKS ON SHARP STEEP CORNERS.

5) As the snow builds up during the winter, twigs and branches which could not be reached in the fall could well be brushing the taller skiers' faces. A check around the course with saw and pruners will eliminate these painful objects.

6) The ski trail is not packed again until the tracks are really well worn and no longer hold the skis. A heavy snowfall makes poling too hard and obliterates the track therefore requiring track setting.

7) The snow on either side of the ski track must be well packed so that the poles can be planted firmly without giving way.

Note:

To ensure that a good ski track is developed and to ensure that it remains for a long time (sometimes long into the spring) **regular** track setting procedures should be followed. The key is to start **packing** a trail with the first adequate snowfall and to continue packing that ski trail on a regular basis.

If the course gets too icy, obtain a cutter to lift up the icy sections and re-shape it with fine crushed snow. Ultimately the track itself should be quite firm with a thin covering of loose/powdered snow on top for grip.

To know when to pack and when not to pack is a problem. When it is very mild, packing can cause squeezing of water to the surface, thereby creating ice. Thoroughly wet snow should be allowed to freeze and dry up a little before packing and track setting.

After a thaw, hand shovelling is sometimes necessary to fill wash outs and drifts should either be broken down by cross-checking or shovelling. Snow will not freeze until it has been disturbed, so all major movement of snow or trail changes has to be done well in advance of the day the trail is being skied.

Mechanical grooming or any disturbing of snow should not be carried out with immediate anticipation of freezing rain. The cushion of snow mixed with crust can then be broken up and mixed together to create passable skiing immediately following such a storm. Turns in trails should be sweeping curves, if possible, to accommodate the turning radius of grooming machines. Short hummocks or hollows should be filled with short logs to remove wash board effect from the trail and also permit undersnow drainage.

On steep slopes going into curves **don't** set any tracks in the curve itself. This allows the unsure skier a chance to snowplow or side-step through without any problems.

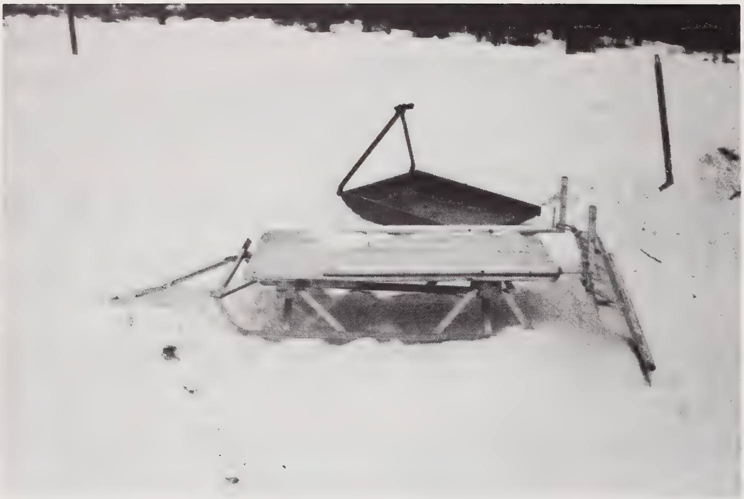
TRACK SETTERS

There are a number of different track setting machines and equipment available today that greatly advance the art of establishing a **good** ski-track.

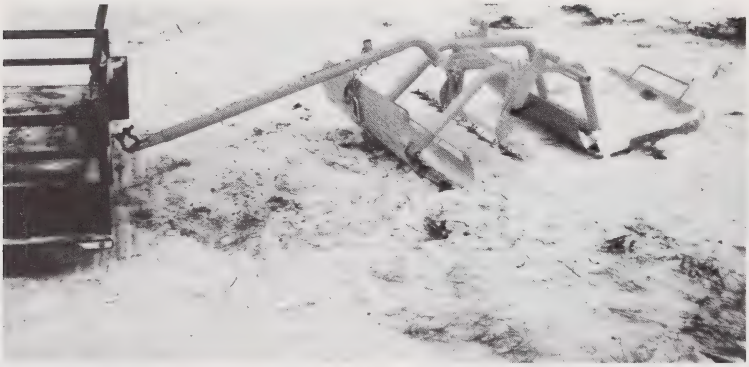
The equipment ranges from self-contained, self-powered BOMBARDIER BOMB/SNOW MACHINES that do everything including packing the trail, cutting ice, setting the ski-track, and fluffing up the snow; to simple hand-made tracksetters that are pulled/dragged behind a snowmobile (see diagrams and photos).

Basically a track setter is very much like a heavy sled, with a fixed hitch that is dragged behind a snowmobile. Protruding through the bottom of the track setter are two plates which cut tracks the width of each ski and six inches apart on the inside edges.

There are some deluxe versions of these drag units such as the BOCHLER track-setter (in operation in Jasper National Park) which also cuts through ice, fluffs up the snow and resets a firm track. However, it is expensive and perhaps a custom design could be made locally for much less.



"SLED-TYPE" DRAG UNIT TRACK SETTERS



BAECHLER TRACK SETTER

ADDITIONAL FACTORS

Lighted Trails:

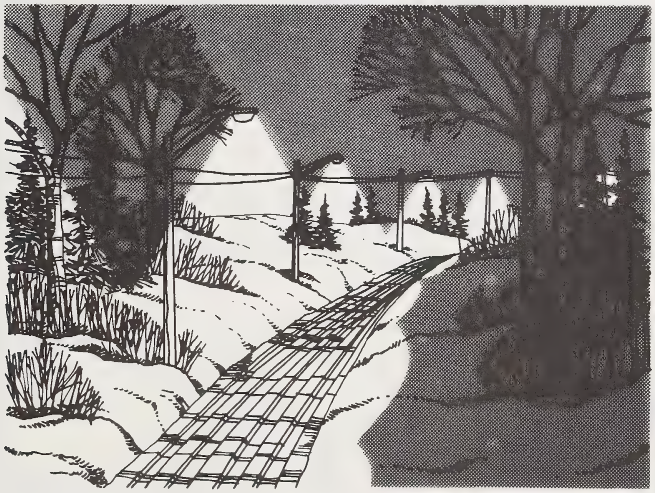
Commercial operators or park managers close to large population areas may find it feasible to provide short loops of lighted trails for night use. This is done commonly in municipal parks in Norway, and lighted trails are becoming more common in this country.

Careful design and trail layout can minimize the number of lights and length of power line necessary. The reflective nature of snow makes it easy to illuminate, and a well-set ski trail can be skied almost by "feel", so lighting need only be minimal. Lights sited at turns can illuminate two or more sections of trail, and trails which double back or have two-way sections can multiply lighting effectiveness.

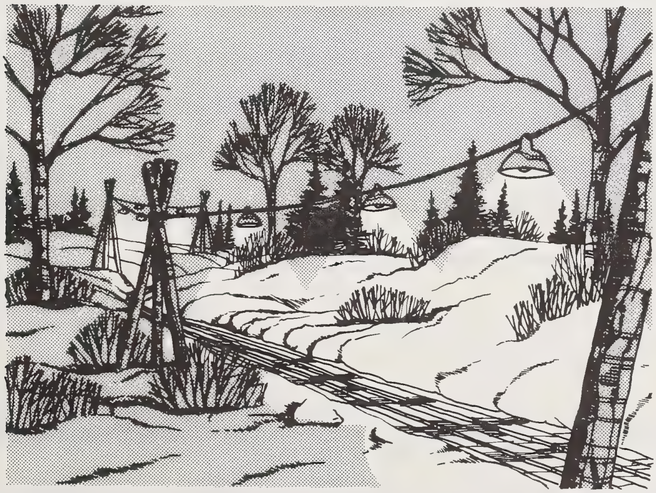
Urban trails can be designed to take advantage of existing street and park lighting patterns. Where new lighting systems must be built, local electric power companies can be approached to donate expertise — and sometimes materials as well.

Even a short section of lighted trail (2 km or so) can be extremely attractive to skiers; this is especially true in metropolitan areas where week-night skiing allows people to get outdoor exercise all week long throughout the winter.

TRAIL LIGHTING VARIATIONS



URBAN TRAIL LIGHTING USING EXISTING LIGHTING



PORTABLE OR REMOVABLE TRIPODS

FIXED POLES

Auxiliary Facilities:

Depending on how long your trail system is and over what type of terrain it follows, the establishment of rest stops can be considered utilizing shelters or huts along the trail. These can be used for emergencies, to get out of the cold at a half way point along the trail loop, or as lunch stops at certain destination points along the trail.

Snowmobile Deterrents:

Snowmobiles can be the single most destructive component along a cross-country ski trail once it has been established.

Most snowmobile problems start right at the trail head or staging area where people park their cars and put on their skis.

Signing has been one suggestion as to how to control snowmobiles. If it is a local trail, community awareness of it's purpose becomes another method.

Working with a snowmobile club or local snowmobilers in helping the ski-club to set trails etc. can also be a means to minimize unnecessary snowmobile interference. In working with the snowmobilers the option of developing a separate snowmobile trail in the same area can also be considered.

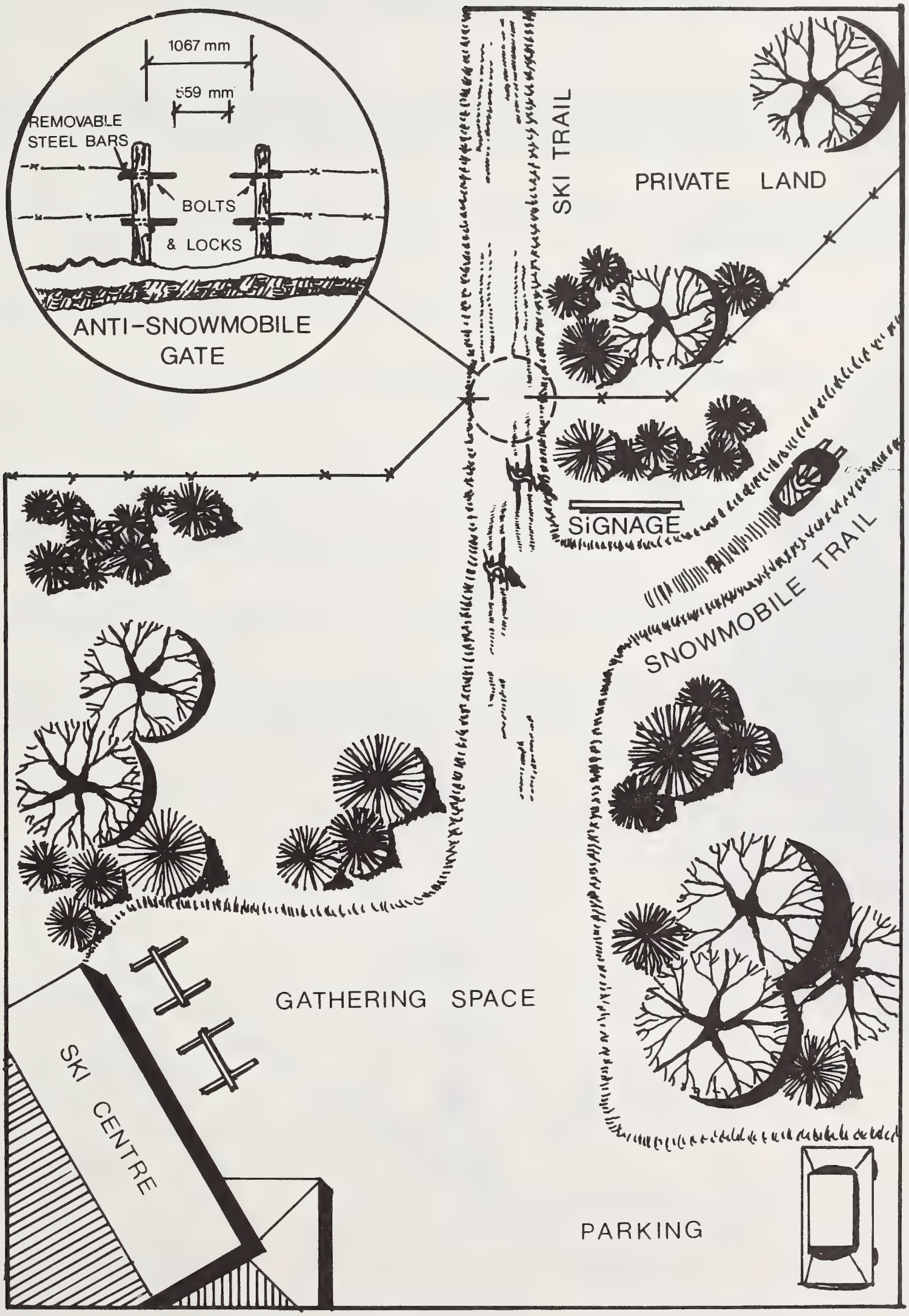
Finally an anti-snowmobile gate can be erected at the start of the ski-trail and works especially well if there is existing fencing in place. The locked metal bars (in the diagram) can be pulled back to permit snowmobile access when setting a track, but when in place do not allow snowmobile passage.

A simple chain gate can also be used that is wide enough for a skier to pass but not a snowmobile.

MULTIPLE USE TRAILS

In planning the trail system it makes good sense to give consideration to possibly developing a multiple-use trail. That is, although you are planning for a cross-country ski trail now, could that trail be used by other user groups especially at different times of the year.

Perhaps the ski trail can be laid out in such a way that skiers would also enjoy the trail experience in the summer time as hikers.



SEPARATION OF TRAIL USE

SUMMARY

This manual has tried to give the basics required to establish a successful ski trail system. Using points presented as well as some common sense and flexibility to reflect local conditions will go far in planning, developing and maintaining a high quality ski trail that will provide a great deal of enjoyment for those who use it.

Again, if further assistance is required, planning consultants from Alberta Recreation and Parks are available for specific problems.

ADDITIONAL INFORMATION SOURCES

The following is a list of some references and contacts that can be used if further information or assistance regarding ski trail development is required:

References

Buss, Ben. **Edmonton Ski Trails,** Edmonton, 1972.

Knopp, Timothy. **Ski Touring Trail Planner,** United States Ski Association, Central Division, Minnesota, 1973.

Proudman, Robert. AMC **Field Guide to Trail Building and Maintenance,** Washington, D.C. Appalachian Mountain Club, 1977.

For specific information on Grooming Equipment see:

Vint, Bill, Editor **Snotracks Guide to Snowmobile Trail Grooming** Fall/Winter 1976, Vol. 1, No. 1, 225 E Michigan Ave. Milwaukee/Wisconsin 53202.

Canadian Association of Nordic Ski Instructors (CANSI), Head Office, 3300 - Cavendish Blvd., Rm. 645, Montreal, Quebec, H4B 2M8.

Ontario Ski Council, **Cross-Country Ski Trail and Facility Design Manual,** 160 Vanderhoof Avenue, Toronto, Ontario M4G 4B8, (416) 429-7701, (416) 421-6700.

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Alberta Recreation and Parks
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